determining a phase shift between the reflected first light pulses from the second grating and the reflected second light pulses from the first grating.

2. (once amended) The method of claim 1, further comprising:

comparing the phase shift from the successive pulses; and

determining a change in magnitude of the measured parameter from the comparison of the successive phase shifts.

3. (once amended) The method of claim 1, further comprising impressing a modulation carrier onto the first light pulses.

4. (once amended) The method of claim 1, further comprising directing the first and second light pulses along the optical fiber and through an optical splitter.

5. (once amended) The method of claim 1, wherein the receiving reflected first light pulses and reflected second light pulses from the first grating and receiving reflected first light pulses and reflected second light pulses from the second grating comprises directing the reflected first and second pulses through an optical splitter and impinging the reflected first and second pulses upon an optical receiver.

6. (once amended) The method of claim 1, further comprising directing the second light pulses through a time delay device.

7. (once amended) The method of claim 1, wherein the known time period of delay is about the same as the double-pass time of the light pulses through the sensor.

8. (once amended) The method of claim 1, wherein generating light pulses comprises using a continuous output [DFB] <u>distributed feedback</u> laser and an integrated optics chip.

9. (once amended) The method of claim 1, wherein generating light pulses comprises generating light pulses of about 1 μsec in duration.

10. (once amended) The method of claim 1, wherein the known time period is about 1 μsec.

11. (once amended) The method of claim 1, wherein the first and second periodic gratings are tailored to reflect light having a wavelength of about 1545 nm.

12. (once amended) The method of claim 1, wherein the successive pulses are generated at about 16 μsec intervals.

13. (once amended) An apparatus for interrogating at least one interferometric fiber optic sensor, the sensor optically connected between a pair of reflective gratings and further coupled to a pipe, the apparatus comprising:

a light source;

a first optical coupler optically connected to the light source;

a first optical path optically connected to the coupler and including a time delay device;

a second optical path optically connected to the coupler;

a second coupler optically connected to the first and second optical paths;

a directional coupler optically connected to the second coupler;

an optical transmission cable optically connected to the [optical circulator] <u>directional coupler</u> and optically connected to the at least one interferometric fiber optic sensor;

a photo receiver optically connected to the [circulator] <u>directional coupler</u>; and

an interrogator connected to the photo receiver.

14. (once amended) The apparatus [as set forth in] <u>of</u> claim 13, wherein the second optical path includes a modulation carrier device.

15. (once amended) The apparatus [as set forth in] <u>of</u> claim 13, further comprising an optical amplifier optically connected thereto.

16. (once amended) The apparatus [as set forth in] <u>of</u> claim 13, wherein the time delay has an optical length and the sensor has a nominal optical length and wherein the optical length of the time delay is substantially the same as twice the nominal optical length of the sensor.

17. (once amended) The apparatus [as set forth in] <u>of</u> claim 13, wherein the pipe includes a fluid flowing therethrough, and wherein the at least one sensor comprises:

an acoustic signal sensing array having a plurality of sensors, each sensor wrapped a plurality of turns around a circumference of the pipe;

wherein optical power sent from the light source connected to the apparatus travels into the acoustic signal sensing array and reflected pulses are received by the photo receiver relating to an acoustic signal;

a local pressure variation sensing array having a plurality of sensors, each sensor wrapped a plurality of turns around the circumference of the pipe; and

wherein optical power sent from the light source connected to the apparatus travels into the acoustic signal sensing array and reflected pulses are received by the photo receiver relating to the local pressure variation.

18. (once amended) The apparatus of claim 17, wherein the reflective gratings reflect the same [nominal] wavelength.

26. (once amended) The apparatus of claim 13, wherein the [photo receiver comprises a tri-mask splitter each optically connected to a photo receiver] <u>directional coupler comprises an optical circulator</u>.

27. (once amended) The apparatus of claim 13, wherein the light source comprises a continuous output [DFB] <u>distributed feedback</u> laser and an integrated optics chip to gate the light on and off at predetermined intervals.

28. (once amended) The apparatus of claim 27, wherein the intervals are about 1 μsec in duration.

29. (once amended) The apparatus of claim 13<u>,</u> wherein the gratings are tailored to reflect light having a wavelength of about 1545 nm.

30. (once amended) The apparatus of claim 13<u>,</u> wherein the optical length of the time delay is substantially [and] <u>equal to a</u> nominal optical length of the sensor [are each about 1 μsec]<u>.</u>

31. (once amended) The apparatus of claim 27<u>,</u> wherein the intervals are about 16 μsec apart.

- **Please add new claims 32-55.**

32. (New) A method for sensing fluid flowing within a pipe, comprising:
   placing at least one optical sensor on an outside surface of the pipe, wherein the sensor is bound by a pair of first and second reflectors;
   creating a first light pulse and a second light pulse from an incident light pulse, wherein the second light pulse is delayed by a time period relative to the first pulse;
   directing the first and second light pulses to the sensor;
   combining the first light pulse reflected from the second reflector and the second light pulse reflected from the first reflector; and
   determining a phase shift between the reflected first and second light pulses to determine a parameter of the fluid within the pipe.

33. (New) The method of claim 32, wherein the sensor comprises at least one wrap of fiber optic cable.

34. (New) The method of claim 32, further comprising imparting a modulation carrier onto the first light pulse.

35. (New) The method of claim 32, wherein the second light pulse is delayed relative to the first pulse by splitting and recombining the incident light pulse prior to directing the first and second light pulses to the sensor.

36. (New) The method of claim 35, wherein the second light pulse is delayed relative to the first pulse by passing the second light pulse through an optical time delay.

37. (New) The method of claim 32, wherein the first and second light pulses are directed to the sensor along an optical pathway.

38. (New) The method of claim 37, wherein the first light pulse reflected from the second reflector and the second light pulse reflected from the first reflector are combined on the optical pathway.

39. (New) The method of claim 38, wherein the optical pathway is coupled to a photo receiver.

40. (New) The method of claim 39, wherein the optical pathway is coupled to the photo receiver by an optical circulator.

41. (New) The method of claim 40, wherein the photo receiver is coupled to instrumentation to determine the phase shift.

42. (New) The method of claim 32, wherein the sensor comprises an optical sensor having a double-pass optical time-of-flight between the first and second reflectors, and wherein the time period is approximately equal to the double-pass time-of-flight.

43. (New) The method of claim 32, wherein the incident light pulse is created by a gateable distributed feedback laser.

44. (New) The method of claim 32, wherein the light pulse has a duration approximately equal to the time period.

45. (New) The method of claim 32, further comprising a serially-connected plurality of sensors each bound by a pair of first and second reflectors.

46. (New) The method of claim 45, wherein each sensor comprises its own unique pair of first and second reflectors.

47. (New) The method of claim 46, wherein each pair of reflectors reflects light of a wavelength different from the other pairs of reflectors.

48. (New) The method of claim 45, wherein each pair of first and second reflectors is not unique to a sensor such that the first reflector of a first sensor comprises the second reflector of a second sensor adjacent the first sensor.

49. (New) The method of claim 48, wherein each of the pairs of reflectors reflect light of a common wavelength.

50. (New) The method of claim 45, wherein the sensors detect acoustic disturbances in the fluid that travel at the speed of sound in the fluid.

51. (New) The method of claim 45, wherein the sensors detect acoustic disturbances in the fluid that travel at the speed of the fluid.

52. (New) The method of claim 45, wherein the sensors comprise at least one wrap of fiber optic cable.

53. (New) An apparatus for sensing fluid flowing within a pipe, comprising:

a light source for emitting an incident light;

a first and second optical path each having a first end and a second end, wherein the first ends are optically coupled to a light source, wherein the second ends are optically coupled to an optical transmission line, and wherein the incident light travels through the second path at a time delay relative to the first path;

at least one optical sensor coupled to the optical transmission line, wherein the sensor is placed on an outside surface of the pipe to detect acoustic disturbances within the fluid, and wherein the sensor is bounded by a pair of first and second reflectors; and

a photo receiver optically coupled to the transmission line.

54. (New) The apparatus of claim 53, wherein the sensor comprises at least one wrap of fiber optic cable.

55. (New) The apparatus of claim 53, further comprising a modulator for imparting modulation to the incident light traveling down the first path.

56. (New) The apparatus of claim 53, wherein the time delay is created by an optical delay element in the second path.

57. (New) The apparatus of claim 56, wherein the optical delay element comprises a delay coil.

58. (New) The apparatus of claim 53, wherein the transmission line is coupled to the photo receiver by an optical circulator.

59. (New) The apparatus of claim 53, wherein the first ends are coupled to a first coupler, and the second ends are coupled to a second coupler.

60. (New) The apparatus of claim 53, wherein the photo receiver is coupled to instrumentation to determine a phase shift in pulses reflected from the sensor.

61. (New) The apparatus of claim 53, wherein the sensor has a double-pass optical time-of-flight between the first and second reflectors, and wherein the time delay is approximately equal to the double-pass time-of-flight.

62. (New) The apparatus of claim 53, wherein the light source comprises a gateable distributed feedback laser.

63. (New) The apparatus of claim 53, wherein the light source emits at least one pulse with a duration equal to the time delay.

64. (New) The apparatus of claim 53, wherein the optical transmission line includes an optical amplifier.

65. (New) The apparatus of claim 53, further comprising a serially-connected plurality of sensors each bound by a pair of first and second reflectors.

66. (New) The apparatus of claim 65, wherein each sensor comprises its own unique pair of first and second reflectors.

67. (New) The apparatus of claim 66, wherein each pair of reflectors reflects light of a wavelength different from the other pairs of reflectors.

68. (New) The apparatus of claim 65, wherein each pair of first and second reflectors is not unique to a sensor such that the first reflector of a first sensor comprises the second reflector of a second sensor adjacent the first sensor.

69. (New) The apparatus of claim 68, wherein each of the pairs of reflectors reflect light of a common wavelength.

70. (New) The apparatus of claim 65, wherein the acoustic disturbances in the fluid travel at the speed of sound in the fluid.

71. (New) The apparatus of claim 65, wherein the acoustic disturbances in the fluid travel at the speed of the fluid.

72. (New) The apparatus of claim 65, wherein the sensors comprise at least one wrap of fiber optic cable.